USAWC STRATEGY RESEARCH PROJECT

TRANSFORMATION OF ARMY TEST AND EVALUATION

by

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ABSTRACT

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In the late 1990's, the U.S. Army implemented significant organizational and procedural changes in the conduct of "independent evaluations" of Army developmental systems. While these changes significantly improved the planning and conduct of independent evaluations in support of the materiel acquisition process, disconnects and inefficiencies persist within and between the Army's test and evaluation and analysis communities. This Strategy Research Project will describe the recent evolution of the organizations and processes currently involved in Army evaluation, and will then propose additional changes that will further streamline Army weapon systems analysis and evaluation.

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

LIST OF TABLES

TRANSFORMATION OF ARMY TEST AND EVALUATION

The purpose of Test and Evaluation (T&E) during the development and acquisition of a defense system is to identify and understand the areas of risk that must be accepted, reduced, or eliminated.[1] A desire to control costs and to reduce acquisition cycle time (and more quickly field the latest technological advances) often is manifested in pressure to reduce the scope or forego portions of the T&E process, including Operational Test and Evaluation (OT&E). However, as a 1987 GAO report on OT&E recognizes, inadequate T&E can lead to increased operational risk:

> If adequate OT&E is not done and the weapon system does not perform satisfactorily in the field, significant changes may be required. Moreover, the changes will not be limited to a few developmental models, but may also be applied to items already produced and deployed. In extreme situations, DoD also risks (1) deploying systems, which cannot adequately perform significant portions of their missions, thus degrading our deterrent/defensive capabilities and (2) endangering the safety of military personnel who operate and maintain the systems.[2]

While the primary purpose of T&E is to support acquisition decisions, a secondary purpose is to support the broader Army and Defense "analysis community". This community is comprised of the various analysis organizations that determine force structure and warfighting requirements. Test data are used to validate the estimates of systems performance and the Models and Simulations (M&S) that are used by these organizations. Similarly, validation with test data improves the pedigree of the performance estimates that are used by operational forces in exercises and experiments as well as in weaponeering. Weaponeering is defined by the Air Force as "the process of estimating the quantity of a specific type weapon required to achieve a specific level of damage to a given target, considering target vulnerability, weapon effects, munition delivery errors, damage criteria, probability of kill, weapon reliability, etc."[3]

During the past decade, the Army has implemented major changes to the organizational structure, responsibilities, and relationships in its T&E and analysis organizations. These changes were intended to improve efficiency by consolidating similar functions that were previously scattered across various Army organizations. While these changes have led to improvements, room for future improvement still exists. For example, T&E functions are still split between the Army Test and Evaluation Command (ATEC) and the Army Materiel Command (AMC). Furthermore, the changes made to date have not eliminated the long-running criticism that the T&E process does not adequately test systems in a realistic joint operational context.

This Strategy Research Project describes the strategic relevance of T&E, characterizes the interaction of the Army's analysis community with T&E, and reviews the organizational evolution of the Army's T&E infrastructure. It then proposes additional changes to streamline business processes and improve Army evaluation and analysis capabilities.

STRATEGIC RELEVANCE

The Research, Development, Test and Evaluation (RDT&E) of military systems directly supports the *Ends, Ways*, and *Means* that are set forth in various defense policy documents. For example, the Defense Policy Goals (*Ends*) contained in the *2001 Quadrennial Defense Review* are "Assuring Allies and Friends," "Dissuading Future Military Competition," "Deterring Threats and Coercion Against U.S. Interests," and "If Deterrence Fails, Decisively Defeat Any Adversary." Among the seven Strategic Tenets (*Ways*) to achieve these goals, RDT&E is a component of four: "Managing Risks", "A Capabilities-Based Approach", "Developing a Broad Portfolio of Military Capabilities", and "Transforming Defense".[4] The Quadrennial Defense Review also points out that one of the four "pillars" of transformation is experimentation using wargaming, simulations and field exercises.

The objective (*End*) of the Defense Acquisition System (of which RDT&E is primary amongst the *Ways*), is "to acquire quality products that satisfy user needs with measurable improvements to mission capability and operational support, in a timely manner, and at a fair and reasonable price."[5] The standard T&E process (*Means*) currently used to support the acquisition of new materiel is described in the DoD *Interim Defense Acquisition Guidebook* and Army Regulation 73-1, *Test and Evaluation Policy*. The "product" of the Army T&E process is an understanding of system capabilities , which is documented in integrated (developmental and operational) evaluations used to inform production and fielding decisions. This process consists of the collection of data from Developmental Tests, Operational Tests, Modeling and Simulation (M&S), Demonstrations , and Experiments in order to evaluate the Effectiveness, Suitability, and Survivability of the system under development.[6] Developmental Test and Evaluation is used as an engineering development/design tool and to verify the inherent technical capabilities offered by new technologies and systems.[7] Operational Test and Evaluation is defined as:

> the field test, under realistic combat conditions , of any item of (or key component of) weapons, equipment, or munitions for the purpose of determining the effectiveness and suitability of the weapons, equipment or munitions for use in combat by typical military users; and the evaluation of the results of such test.[8]

Operational Test and Evaluation is thus used to assess the degree to which soldiers can leverage a system's technical capabilities in a realistic operational field test context. Title 10, United States Code sets forth statutory requirements for the conduct of Operational Test and Evaluation[9] and realistic survivability/lethality Live Fire Test and Evaluation[10] for major systems and munitions prior to proceeding beyond Low-Rate Initial Production.

T&E AND ANALYSIS ORGANIZATION INTERDEPENDENCIES

Numerous organizations within the Army and Defense Department rely on weapon-system data in the conduct of their analysis missions. Figure 1 depicts the typical information flow between these organizations. The paragraphs that follow describe the missions and relationships of key organizations in Army T&E and analysis.

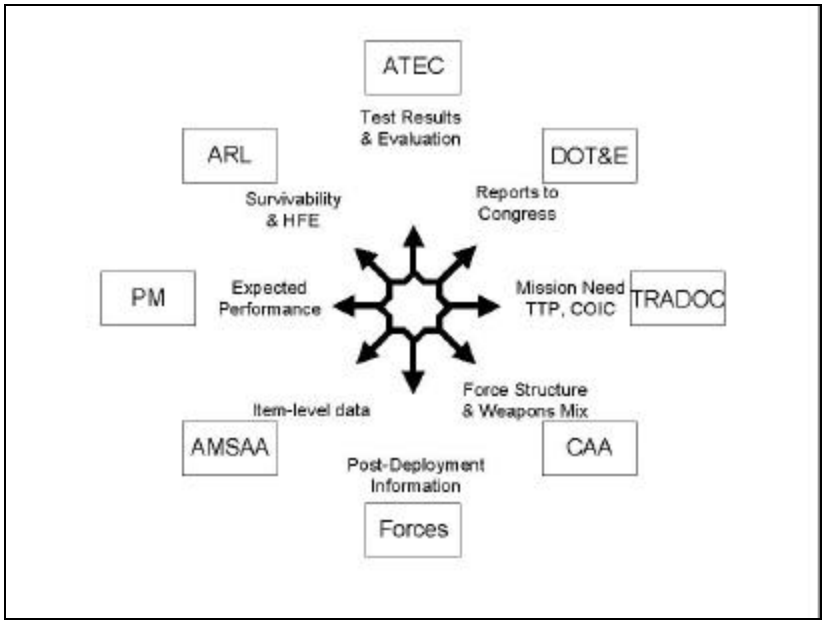

FIGURE 1. T&E AND ANALYSIS INTERDEPENDENCIES

DIRECTOR, OPERATIONAL TEST AND EVALUATION (DOT&E)

In 1983, Congress created the statutory requirement for the Defense Department to establish a DOT&E to oversee Service Operational Test and Evaluation programs. In 1994, the DOT&E assumed responsibility for oversight of Live Fire Test and Evaluation (LFT&E) programs. The Director of DOT&E, who is a Presidential appointee requiring Senate

confirmation, prepares annual reports to Congress on all major defense acquisition programs. The functions and duties of DOT&E are described in Title X, United States Code, Sections 139, 2366, 2399 and 2400.[11] The responsibilities of DOT&E are specified in Section 139:

> The Director shall –
>
> (1) prescribe, by authority of the Secretary of Defense, policies and procedures for the conduct of operational test and evaluation in the Department of Defense;
>
> (2) provide guidance to and consult with the Secretary of Defense and the Under Secretary of Defense for Acquisition, Technology and Logistics and the Secretaries of the military departments with respect to operational test and evaluation in the Department of Defense in general and with respect to specific operational test and evaluation to be conducted in connection with a major defense acquisition program;
>
> (3) monitor and review all operational test and evaluation in the Department of Defense;
>
> (4) coordinate operational testing conducted jointly by more than one military department or defense agency;
>
> (5) review and make recommendations to the Secretary of Defense on all budgetary and financial matters relating to operational test and evaluation, including operational test facilities and equipment, in the Department of Defense; and
>
> (6) monitor and review the live fire testing activities of the Department of Defense provided for under section 2366 of this title.[12]

DOT&E is also responsible for the execution of the Joint Technical Coordinating Group for Munitions Effectiveness (JTCG/ME), which has the mission of publishing operational effectiveness estimates for all non-nuclear weapons and standardizing effectiveness measures and methodologies used by the services. These estimates are published in Joint Munitions Effectiveness Manuals and include descriptions of weapon system characteristics , such as detection ranges, engagement ranges, fly-out times, delivery accuracy, reliability, and kill probabilities. JTCG/ME data and Joint Munitions Effectiveness Manuals are used by a variety of U.S. and Allied combatant commanders, analysis organizations, trainers , and defense planners in weaponeering, training, tactics development and weapons systems studies.[13]

ARMY TEST AND EVALUATION COMMAND (ATEC)

The Army is unique among the services in having a single organization, ATEC, which is responsible for developmental testing, operational testing, and the continuous (through all

phases of a program's life cycle) integrated (developmental and operational) evaluation of materiel. The primary "products" of ATEC are test data and systems evaluations. DOT&E uses ATEC products as the primary input for "beyond low-rate initial production" reports to Congress. Program Managers and Acquisition Executives also use ATEC products in materiel acquisition and fielding decisions. ATEC evaluations determine the degree to which materiel is effective, suitable, and survivable. These evaluations typically include recommended system improvements or "operational work-arounds" (changes to Tactics, Techniques and Procedures) to overcome capability limitations observed in testing.

The ATEC commander is a major general who reports directly to the Vice Chief of Staff of the Army. ATEC is comprised of three major subordinate commands. The Developmental Test Command, headquartered at Aberdeen Proving Ground, Maryland, manages developmental test centers throughout the U.S. and plans, conducts, and reports on developmental tests. The Operational Test Command, headquartered at Fort Hood, Texas, manages operational test centers throughout the U.S. and plans, conducts, and reports on operational tests. The Army Evaluation Center, headquartered in Alexandria, Virginia, develops evaluation plans, determines data requirements and sources (analysis, developmental testing, operational testing, M&S, exercises), observes testing, and evaluates system effectiveness, suitability, and survivability. Also unique among the services is the fact that ATEC, as the Army's Operational Test Agency is responsible for defining LFT&E requirements and reporting on LFT&E results (program managers assume this responsibility in other services). The unique characteristics of ATEC activities were endorsed by a 1999 Defense Science Board recommendation, which implicitly urged the other services to adopt the Army/ATEC model:

> Each of the Service DT&OT organizations should be consolidated, to include integrated planning, use of models, simulation and data reduction. Planning should be totally integrated, and the OSD T&E organizations consolidated. There should be integrated use of models, simulation and data reduction. Except for limited dedicated Operational Test and Evaluation (OT&E), contractor and government testing should also be integrated.[14]

ARMY RESEARCH LABORATORY (ARL)

ARL is a component of the Army Materiel Command's Research Development and Engineering Command. Two elements of ARL are heavily involved in the T&E process – the Survivability/Lethality Analysis Directorate and the Human Research and Engineering Directorate.

Survivability/Lethality Analysis Directorate (SLAD)

SLAD's authorized workforce consists of one hundred and forty seven employees at Aberdeen Proving Ground, Maryland, one hundred and seventeen employees at White Sands Missile Range and twenty employees at Fort Monmouth, New Jersey. The mission of SLAD is to:

- Provide survivability lethality, and vulnerability (SLV) analysis and evaluation support over the entire life cycle of major Army systems and help acquire systems that will survive and/or be highly lethal in all environments against the full spectrum of battlefield threats.
- Provide advice/consultation on SLV issues to HQDA, PEOs/PM, evaluators, combat developers, battle labs, intelligence activities, and other DA and DOD activities.
- Conduct investigations, experiments, simulations, and analyses to quantify SLV of Army and selected foreign weapon systems.
- Provide well-documented timely technical judgments on complex SLV issues.
- Perform special studies and make recommendations regarding tactics, techniques, or design modifications to reduce vulnerability and enhance survivability and lethality of Army materiel.
- Develop tools, techniques, and methodologies for improving SLV analysis.[15]

ATEC relies on SLAD analyses, methodology, M&S, and testing for input to the effectiveness and survivability portions of ATEC evaluations. SLAD conducts all modeling and simulation that supports the pre-test predictions and leads the damage assessment teams for all Army Live Fire Test and Evaluation tests SLAD also manages and conducts live fire testing of Army aviation systems. AMSAA relies on SLAD vulnerability modeling as input in its weapon systems effectiveness calculations. SLAD relies on results of ATEC conducted tests to validate the penetration and behind-armor debris algorithms of SLAD vulnerability models.

Human Research and Engineering Directorate (HRED)

Headquartered at Aberdeen Proving Ground, Maryland, HRED has an authorized staff of two hundred and thirty-five employees, whose mission is:

> To optimize soldier effectiveness and soldier-machine interactions and to ensure that future system designs will enable our soldiers to achieve maximum performance. To fulfill this mission, HRED conducts broad-based scientific research and technology application and provides leadership in human factors integration and support to MANPRINT (manpower and personnel integration).[16]

ATEC relies on HRED MANPRINT analyses in the evaluation of weapons systems suitability.

ARMY MATERIEL SYSTEMS ANALYSIS ACTIVITY (AMSAA)

AMSAA is also an element in the Army Materiel Command's Research Development and Engineering Command. The mission of AMSAA is to "support the Army decision-making process by providing materiel, logistics and industrial systems analyses, as well as business process, manpower and resource analysis." [17] AMSAA headquarters and the majority of AMSAA's workforce of three hundred and eight employees is located at Aberdeen Proving Ground, Maryland. Small satellite offices are located in Philadelphia, Pennsylvania; Letterkenny, Pennsylvania; Redstone Arsenal, Alabama; and Rock Island, Illinois.

AMSAA's core business areas include methodology development; analysis; and M&S development, use, verification and validation.[18] AMSAA provides and certifies item-level and system-level performance data for use in all Army studies. The JTCG/ME Coordination Office in AMSAA manages the JTCG/ME program for DOT&E. Item and system level performance data that are provided by AMSAA or are contained in Joint Munitions Effectiveness Manuals include signatures, accuracy, fly-out times, hit and kill probabilities, reliability, engagement time-lines, emplacement/displacement times, and transit times. ATEC uses AMSAA item-level performance estimates in the real-time casualty assessment instrumentation that is used at ATEC test ranges. ATEC relies on AMSAA analytical support in the areas of weapons systems effectiveness (such as using SLAD vulnerability/lethality estimates and test-based delivery accuracy to determine kill probabilities), suitability (such as wholesale/retail supply and maintenance analyses), and survivability (such as missile in-flight survivability). AMSAA relies on information from ATEC tests and evaluations to update their item-level and system-level performance databases.

PROGRAM MANAGER (PM)

The PM is responsible for managing all aspects of a given materiel acquisition program and ensuring that program requirements, including T&E, are achieved within approved resource and time constraints. The PM, working with his prime contractor, develops system specifications that are intended to result in the development of a system that meets TRADOC developed operational requirements. Until validated or updated by test results, these requirements and specifications typically form the basis for item level performance data and Model and Simulation inputs.

TRAINING AND DOCTRINE COMMAND (TRADOC)

The principal analysis activity within TRADOC is the TRADOC Analysis Center (TRAC), located at Fort Leavenworth, Kansas and White Sands Missile Range, New Mexico. TRAC is the Army agency responsible for conducting the studies that form the basis of new operations and organization (O&O) concepts and weapon systems operational requirements. TRAC is also the Army's lead analysis agency for the conduct of Advanced Warfighting Experiments. TRAC develops and uses various models and simulations (M&S) in performing its mission.[19] These M&S require as input "item level performance data" that characterize weapons systems. TRADOC combat developers generate the Tactics, Techniques and Procedures as well as the Critical Operational Issues and Criteria that are used by ATEC in the design, conduct, and evaluation of Operational Tests.

CENTER FOR ARMY ANALYSIS (CAA)

CAA, located in Fort Belvoir, Virginia, is the Army's center of excellence for theater/campaign warfare analysis. The CAA mission:

> CAA is an analysis organization that supports HQDA and Major Army Commands. CAA develops information that helps Army top management address the issues of greatest importance to the Army. CAA develops information by conducting studies employing analysis techniques appropriate to the issues at hand. CAA maintains special expertise in the analysis of issues pertaining to theater-level operations and Army-wide processes, especially those involving resource allocation."[20]

Every two years, CAA conducts the quantitative analysis portion of the "Total Army Analysis" to determine unconstrained force structure requirements. The *Concepts Evaluation Model*, used by CAA to determine battle movement, personnel and equipment losses, consumption rates, etc., relies on friendly and enemy weapons effectiveness data amongst its inputs.[21] These weapons effectiveness data are provided by AMSAA.

OPERATIONAL FORCES

Operational Forces include the Combatant Commands, Component Commands, and unattached U.S. Army Forces Command units. These units typically rely on Joint Munitions Effectiveness Manuals or AMSAA effectiveness data for the weaponeering component of mission planning and in the real-time casualty assessment instrumentation systems that are used in training and exercises. ATEC and Project Managers receive post-deployment information from operational forces for use in continuous evaluations.

RECENT ORGANIZATIONAL CHANGES

ATEC is a fairly new organization; it was created at the culmination of a series of major organizational and procedural changes in Army T&E that took place in the 1990's. In 1996, AMSAA conducted a study of T&E reengineering as part of the Functional Area Assessment of Equip, Supply, and Maintain functions . This study concluded that significant efficiencies would be achieved through the integration of developmental and operational evaluation.[22] As a result of this study, Army Evaluation was transformed in October 1996, when the Developmental Evaluation responsibilities and resources of the Army Materiel Command were assigned to the Evaluation Analysis Center, a new organization within the Army's Operational Test and Evaluation Command (OPTEC). The workforce of the Evaluation Analysis Center was created by reassigning ninety-eight employees from AMSAA, eighteen from SLAD, and thirty-five from the Army Materiel Command's Test and Evaluation Command.

In October 1999 the Army Test and Evaluation Command (ATEC) was created to consolidate Army T&E. ATEC was created by reassigning and redesignating the technical test responsibilities and resources of AMC's Test and Evaluation Command as ATEC's Developmental Test Command and by redesignating OPTEC's Test and Experiment Command as the ATEC's Operational Test Command. Also as part of this consolidation, evaluation was further transformed by merging the technical evaluation responsibilities of OPTEC's Evaluation Analysis Center with the operational evaluation responsibilities of OPTEC's Operational Evaluation Command to create ATEC's Army Evaluation Center (AEC), which now has an authorized workforce of five hundred and eighteen employees.[23]

The Research, Development and Engineering Command (RDECOM) of AMC was provisionally established in October 2002. Figure 2 depicts the RDECOM organizational structure. RDECOM consists of the research, development and engineering elements that had previously been assigned to the various AMC Major Subordinate Commands. For example, the Tank and Automotive Research, Development and Engineering Command (TARDEC) had previously been a part of the Tank and Automotive Command (TACOM). The mission of RDECOM is to "Field technologies which sustain America's Army as the premier land force in the world."[24]

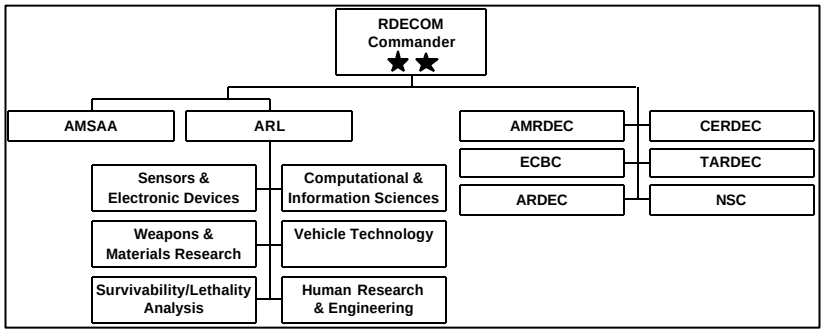

FIGURE 2. RDECOM ORGANIZATION [25,26]

ROOM FOR IMPROVEMENT

The major criticisms of the current T&E process relate to cycle time, costs, and test realism – the degree to which the use of equipment in tests is representative of the way we fight, particularly in view of the joint nature of current and future operations. But the old adage "fast, cheap, good – you cannot have all three" applies. As Michael Wynn, Principal Undersecretary of Defense for Acquisition, testified:

> In fact, as we proceed through trying to shorten the cycle of development to get this technology to our war fighters, we would anticipate that we would encounter more risk, not less risk, and that therefore we would be encountering more test failures, not less test failures.[27]

The job of T&E planners is to attempt to balance the conflicting objectives of speed, affordability, realism and risk in their developmental and operational test designs. Indicators of the importance of realism in T&E are the facts that in the period from 1996-2000, system reliability requirements were met in only 20% of operational tests, and operator error accounted for approximately 50% of system failures.[28] Therefore, realistic "players" conducting operationally realistic tasks under realistic conditions are essential to assess a system's operational reliability.

To expedite materiel fielding in critical cases, the Army uses an Urgent Materiel Release process to quickly field equipment that is urgently needed (in specific quantity, duration, and location) in support of specific operations. This process requires that the gaining command accept, at the General Officer level, all known equipment and supportability issues and risks, including safety and health hazards, operational limitations and restrictions of use. The Urgent Materiel Release process is to be used only in cases where a deployed or deploying force has

an operational need that cannot otherwise be satisfied from Army or Defense inventories . However, this process does not eliminate the need to eventually conduct sufficient data collection to adequately evaluate the system.[29]

One source of inefficiency in the planning of T&E is the number of organizations that are involved in the process. One of the findings in the 1999 Defense Science Board Task force on Test and Evaluation was that "Bureaucratic barriers to cooperation and efficiencies are contributors to an increasingly protracted weapons system development process."[30] T&E overhead is unnecessarily high because each organization typically sends representatives to numerous T&E planning meetings, even though their missions are closely related. Furthermore, the approval of T&E planning and evaluation documents is encumbered by the need for management review of the input from each organization. Program Managers and DOT&E action officers are frequently confused because they are forced to negotiate support, resources, and time-lines with representatives from multiple organizations (for example, ATEC, SLAD and AMSAA each have a role in many LFT&E programs). This bureaucratic structure complicates the prioritization and allocation of limited resources.

Questionable operational realism has been a long-running criticism of operational testing. In 1989, the Assistant Comptroller General testified that "in our 1983 report on DOD's joint operational test and evaluation, we found that unrealistic test conditions… raised serious questions about the validity of the evaluations conducted jointly by the services."[31] Operational realism in a joint environment is an issue of such significance that the *DoD Transformation Planning Guidance* requires:

> Transformation of Test and Evaluation: As the Department transforms to a joint concept-centric approach to operational planning and capabilities development, we need integrated architectures that define the specific parameters of the requisite joint capabilities. A Joint Test and Evaluation Capability (JointTEC) is needed to test the capabilities in a realistic joint environment … Test and evaluation in a joint context will reveal whether or not the integrated architectures present a viable application of warfighting capabilities. A JointTEC would focus policies, plans, methodologies, and resources for evaluation in joint operations environments.[32]

ARMY STRUCTURAL SUGGESTIONS

Efficiencies could be gained in T&E planning and execution by combining AEC, SLAD, HRED and AMSAA into a new AEC - a unified Analysis & Evaluation Center under ATEC. This consolidation would build upon the T&E restructuring that was conducted in the 1990's and would be consistent with the recommendations of the 1999 Defense Science Board Task Force

on Test and Evaluation. This consolidation would also address a Government Accounting Office criticism that separate, independent reviews of T&E facilities and research and development laboratories in the 1995 Base Realignment and Closure process created “artificial barriers” to infrastructure reduction.[33]

Such consolidation would provide “unity of command” in T&E planning and execution; it would eliminate redundant management (including at least two Senior Executive Service level and numerous GS-14/15 level positions) and staff support structures. This consolidation under ATEC would provide greater command emphasis to the work currently performed by SLAD, AMSAA and HRED by reducing the number of command levels between the action officers and the Department of Army customer.

An example of the lack of Research, Development and Engineering Command emphasis on the work of these organizations is the fact that of the 197 articles in the first ten issues of RDECOM magazine (covering 11 months), only one cited work that was being done at AMSAA, SLAD or HRED.[34] This ratio of one half of one percent is significantly less than we would expect from almost six percent of the Research, Development and Engineering Command workforce. This disparity suggests that these analytical elements do not receive as much command attention (and hence priority) as do the elements that develop technologies, which is the main mission of the Research, Development and Engineering Command.

Similarly, consolidation would streamline the planning and execution of JTCG/ME tasks and would eliminate organizational barriers that inhibit timely collection and inclusion of test data into Joint Munitions Effectiveness Manuals. Additional benefits of consolidation would be the elimination of the requirement for Project Managers to negotiate, coordinate and fund T&E support from multiple organizations and the creation of “one-stop-shopping” for DOT&E interaction with the Army on T&E and JTCG/ME issues.

Opponents of this consolidation might argue against it in two principal ways. First, opponents might claim that this consolidation would dilute the existing AEC mission by noting that there are aspects of the SLAD, HRED and AMSAA missions that are not strictly related to evaluation. Considering the “continuous evaluation” requirements of the AEC mission, the SLAD non-evaluation workload is, in reality, very small, consisting mainly of its test and experiment range capabilities. In the proposed consolidation, these capabilities would logically be integrated into ATEC’s Developmental Test Command’s facilities at Aberdeen Proving Ground and White Sands Missile Range.

Similar counter-arguments would apply for HRED as well. AMSAA’s item/system-level performance, acquisition support, M&S, and significant portions of its logistics work efforts are

directly applicable to continuous evaluation. However, some of its logistics work efforts (such as war reserve and contingency force package development) and its business and resource analysis work efforts are not directly related to AEC's evaluation mission. To avoid dilution of the AEC mission, these tasks and the associated resources could easily be divested to another organization within the Army Materiel Command, such as the Logistics Evaluation Agency.

Second, opponents might argue that because of the extent of support that SLAD, HRED and AMSAA provide directly to Program Managers, consolidation with AEC would jeopardize the independence of AEC evaluations. This argument is easily countered by the fact that the AMSAA, SLAD and HRED analysts that currently support Program Managers are typically the same analysts that support AEC evaluations, so evaluations would be no less independent after consolidation than they are today.

JOINT OPERATIONAL TEST REALISM

Several alternative courses of action (COA) to the current Operational Test process could conceivably enhance the operational realism in the representation of joint operations in the events that are used in the Army's Operational Evaluations.

COA 0: This COA is the status quo, in which ATEC, the Army's Operational Test Agency executes the Operational Test using existing policy and procedures. In this COA, the Army's evaluator determines the extent to which Joint "players" are necessary in the Operational Test and is responsible for ensuring (through existing Service Operational Test Agency coordination channels) their participation.

COA 1: In this COA, the Service Operational Test Agencies are replaced by a Joint Operational Test Agency, which is responsible for the planning and execution of the Operational Tests for all programs across DoD.

COA 2: In this COA, a dedicated Joint Transformation Test Unit is created, this unit conducts all Operational Tests.

COA 3: In this COA, traditional Operational Testing is bypassed, with the system being produced and fielded upon the completion of Developmental Testing. Operational evaluation is conducted post-deployment based on a Joint National Training Capability or Combatant Command exercise. In recent years, significant efforts have been made under the auspices of the Defense Test and Training Steering Group to modernize the instrumentation used at our nation's training ranges[35], making their data collection capabilities similar to those of Operational Test ranges. Therefore, it is feasible that exercise venues could provide the data elements required by operational evaluators.

ANALYSIS

Comparison of the four proposed courses of action is based upon their associated risks in the dimensions of Test Unit Realism, Test Operations Realism, Operational Effectiveness, System Cost, Force Readiness, Program Schedule and Statutory Compliance. Table 1 summarizes the comparison.

	COA 0 Status Quo	COA 1 Joint OTA	COA 2 Dedicated Unit	COA 3 Exercise
Test Unit Realism	Medium Risk	Medium Risk	Low Risk	Low Risk
Test Operations Realism	Med/High Risk	Medium Risk	Low Risk	Low Risk
Operational Effectiveness	Low Risk	Low Risk	Low Risk	High Risk
System Cost	Low Risk	Low Risk	Low Risk	High Risk
Force Readiness	Low Risk	Low Risk	Medium Risk	High Risk
Schedule	Medium Risk	Medium Risk	Low Risk	High Risk
Statutory	Low Risk	Medium Risk	Medium Risk	High Risk

TABLE 1. COMPARISON OF COA RISKS

TEST UNIT REALISM

Since COA 3 involves collecting data with line forces in Joint exercises, it presents extremely low risks in test unit realism. COA 2 also has low risk in this dimension, as long as care is taken to ensure that the dedicated test unit does not evolve into a “golden unit” unrepresentative of the rest of the force. The medium risks associated with COA 0 and COA 1 are due to the difficulties in obtaining commitments for realistically sized test units.

TEST OPERATIONS REALISM

COA 2 and COA 3 present low risk in this dimension because both would employ a Joint unit exercising realistic Joint operations. COA 2 poses medium risk because of difficulties in obtaining commitments for realistically sized test units, and COA 0 has Medium/High risk because of the additional challenges that an Army test organization has in securing Joint players in operational tests.

OPERATIONAL EFFECTIVENESS

COA 0, COA 1, and COA 2 present low risk in this dimension because Operational Tests are designed to stress the system-under-test and its operators over a wide range of conditions, threats and environments. Uncontrolled variables associated with the "free-play" nature of exercises, and the requirement to not interfere with training objectives would likely limit the scope of conditions and threats exercised in COA 3[36]. Therefore, there is high risk that system operational deficiencies could go undetected in COA 3.

SYSTEM COST

COA 0, COA 1 and COA 2 present low risk in this dimension because "T&E, especially OT&E is not a big fraction of the overall budget and schedule… Army OT&E costs 0.91% of acquisition."[37] COA 3 poses high cost risks because of the likelihood of system design and performance deficiencies remaining undetected until after purchase and fielding, when costs to fix, retrofit, and confirm are much higher.

FORCE READINESS

COA 0 and COA 1 pose low readiness risk because Operational Tests typically have minimal impact on unit rotations. Since the formation of a dedicated test unit would reduce the units and equipment available for operational deployment, COA 2 poses a medium readiness risk. COA 3 presents a high readiness risk since there is a high risk of system deficiencies remaining undetected until after fielding in COA 3.

SCHEDULE

The availability of a dedicated test unit in COA 2 eliminates test schedule risk – the unit will be available as soon as the equipment is ready to test. Lacking a dedicated unit, when operational tests are delayed because of problems in development, the test schedules may need to be further delayed to synchronize with test unit rotations – therefore, COA 0 and COA 1 present medium schedule risk. There has been a recent trend to cancel major exercises because of "real world" operational commitments. Therefore, COA 3, which relies on exercises for operational evaluation data, poses a high schedule risk.

STATUTORY

COA 0 presents a low risk in this dimension because the current Army process is in full compliance with existing statutory requirements. COA 1 and COA 2 pose medium risk because they reverse the synergistic gains that were realized in the formation of ATEC – gains which have been recognized and recommended by the Defense Science Board (DSB) for adoption in

all services[38]. COA 3 poses high risk in this domain because the elimination of Operational Testing from the defense acquisition process would require the elimination of Section 2399 of Title 10, United States Code – an extremely unlikely event.

JOINT OPERATIONAL TEST REALISM RECOMMENDATION

While COA 3 provides the highest promise of unit and operational realism, risks in other dimensions make COA 3 the least desirable alternative. If improvements in unit and operational realism are truly desired, COA 2 (Dedicated Unit) should be pursued. If, however, current "real world" operational demands on force structure and resources prevent the acceptance of COA 2's higher cost and readiness risks, then COA 0 (Status Quo) should be maintained.

CONCLUSIONS

The organizational consolidation of SLAD, HRED, AMSAA and HRED proposed in this report will provide AEC with the resources, as well as with the responsibility to conduct all aspects of its continuous independent evaluation mission. It will also avail AEC of the resources and responsibility for the Army's contributions to the Joint Technical Coordinating Group for Munitions Effectiveness. These changes will simplify organizational interrelationships within the Army's materiel acquisition community and will improve efficiency.

Because of the expense of large-scale Operational Tests and the difficulties in securing multi-service "player" units, realistic Operational Testing in a Joint Operations context will remain problematic. Therefore, the current T&E process for evaluating systems in a Joint operational context should be maintained. If operations render Joint test units unavailable, Joint interoperability must be certified prior to deployment by using Developmental Test results, and post-deployment data must be used to evaluate Joint operational effectiveness.

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